Benthic Total Maximum Daily Load Study for the Accotink Creek Watershed

Public Meeting #2

July 6, 2015

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Meeting Agenda

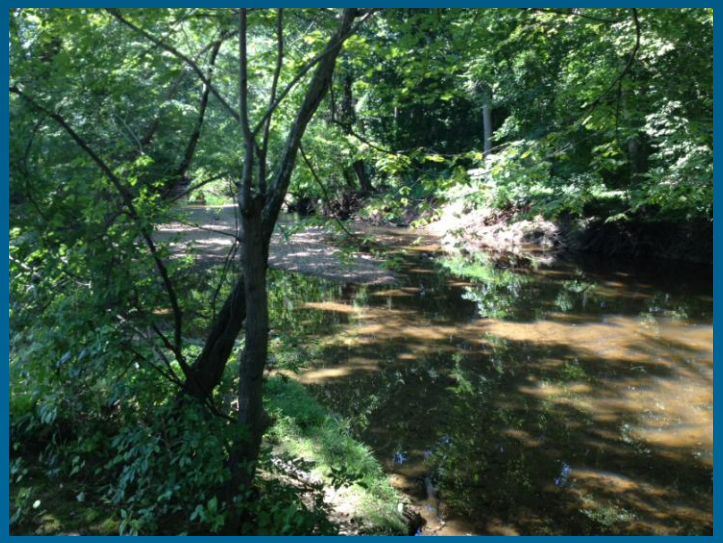
1. Introductions

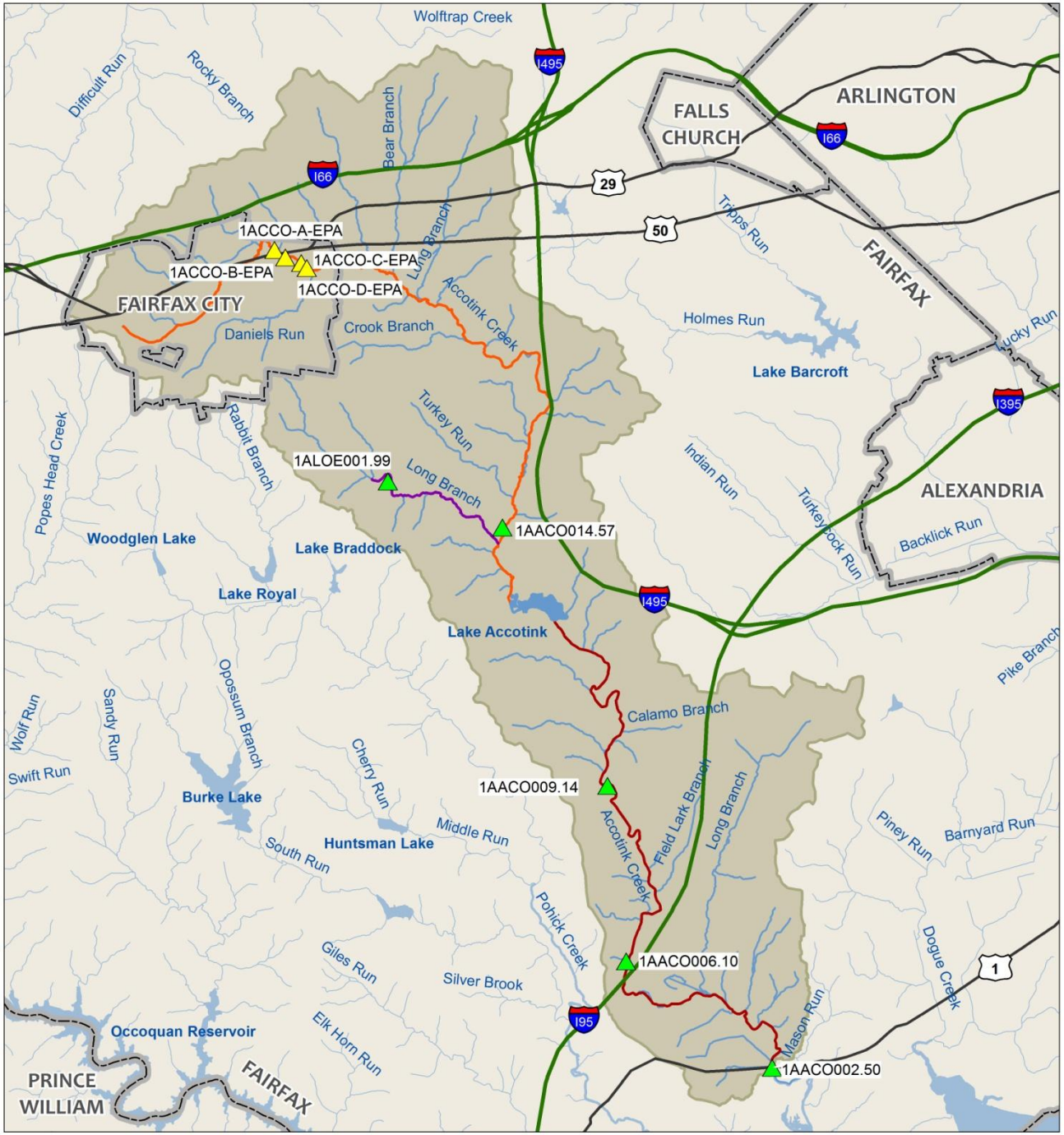
2. Background

3. Results of Draft Stressor Identification Analysis
   a. Available Water Quality Data
   b. Water Quality Standards and Thresholds
   c. Stressors

4. Conclusions & Next Steps

5. Questions & Discussion





Legend

Biological Monitoring Stations

- DEQ
- EPA
- Streams

303d Listed Segments

- A15R-01-BEN
- A15R-04-BEN
- A15-R-05-BEN

Major Roads

- Interstate
- US Hwy
- Jurisdictional Boundaries
- Waterbodies
- Accotink Watershed

Data Sources:
VADEQ – Watersheds, Impaired Segments, Monitoring Stations
USGS – National Hydrography Dataset
ESRI – Roads
US Census – Jurisdictinal Boundaries

N
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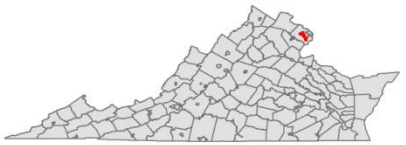
0 0.5 1 2 3 4
Miles

MAP INDEX



What is a Stressor Analysis?

Answers the question: ***What is causing the aquatic life impairment?***

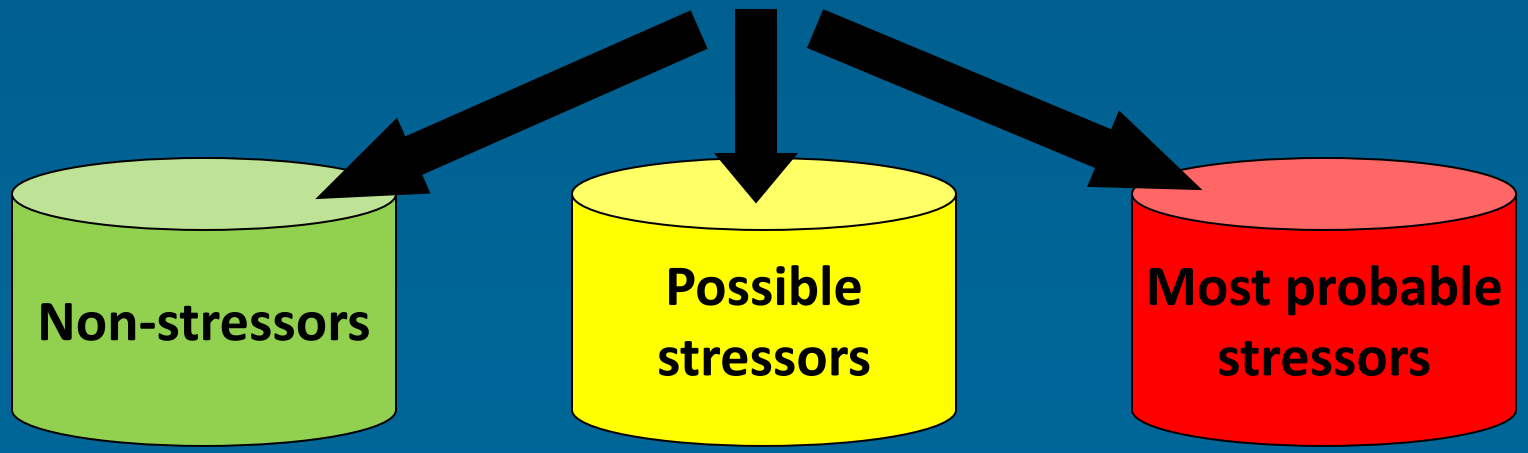
1. List all potential causes, for example:

   Dissolved oxygen, nutrients, pH, sediment, temperature, toxics, etc.

2. Analyze the evidence for and against each cause:

   Biological, habitat, water quality, historic data, etc.

3. Categorize each of the causes as being one of the following:



Stressor Identification Analysis

Accotink Creek and Urban Stream Syndrome

- 87% of the Accotink Creek watershed is in commercial, industrial, residential, or transportation land uses
  - 29% impervious cover (generally see negative impacts >10%)

- Accotink Creek is suffering from the "Urban Stream Syndrome"
  - Flashier flows
  - Elevated nutrient and/or contaminant concentrations
  - Fewer smaller streams and lower stream density
  - Altered channel morphology
  - Reduction in biological diversity with increases in pollution-tolerant taxa

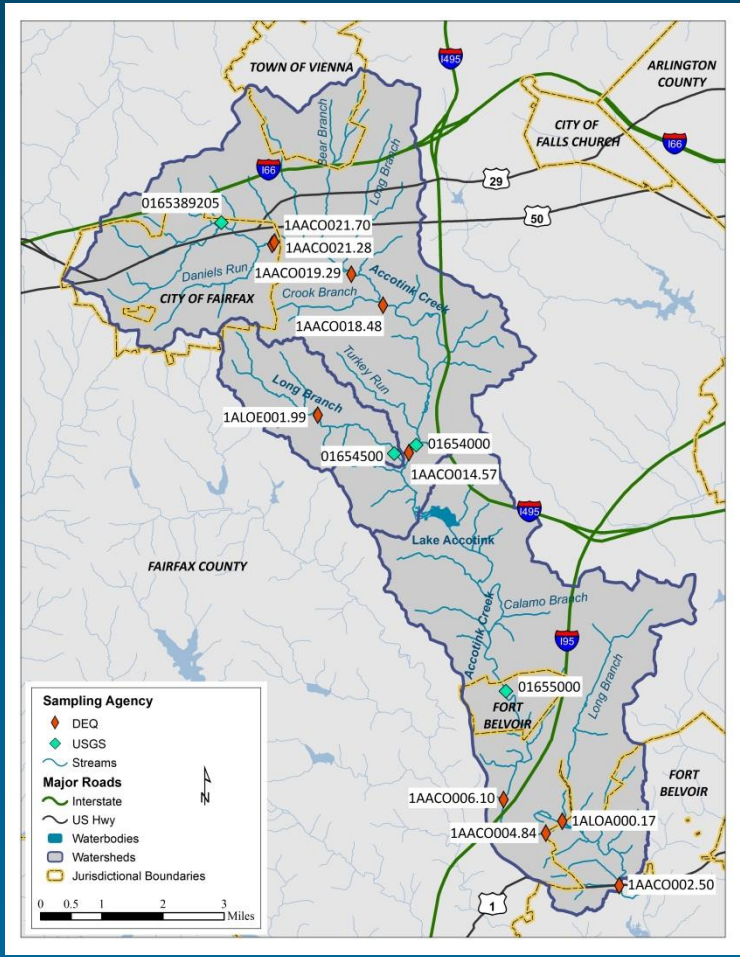
Topics

- Available Monitoring Data
- Water Quality Standards and Benchmarks
- Stressor Analysis
  - Non-Stressors
  - Possible Stressors
  - Most Probable Stressors

Available Data to Assess Candidate Stressors

Candidate Stressor	Available Data
Temperature pH Dissolved Oxygen	Continuous water quality monitoring Discrete water quality samples
Nitrogen Phosphorus Chloride	Discrete water quality samples
Metals Toxics	Discrete water quality samples Sediment samples Fish tissue samples
Habitat Modification Sediment Hydromodification	Habitat assessment Fairfax County Stream Physical Assessment

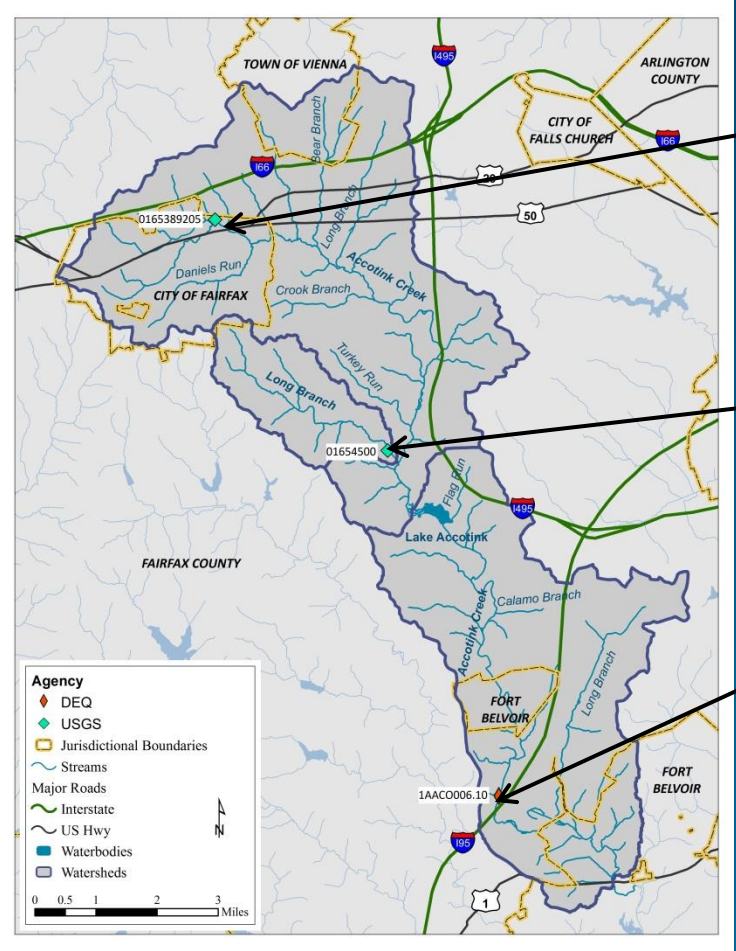
Conventional Water Quality Monitoring, 2004 -2014



Number of Discrete Samples :

Watershed	DEQ	USGS
Upper Accotink Creek	122	174
Lower Accotink Creek	111	0
Long Branch	2	74

Continuous Monitoring

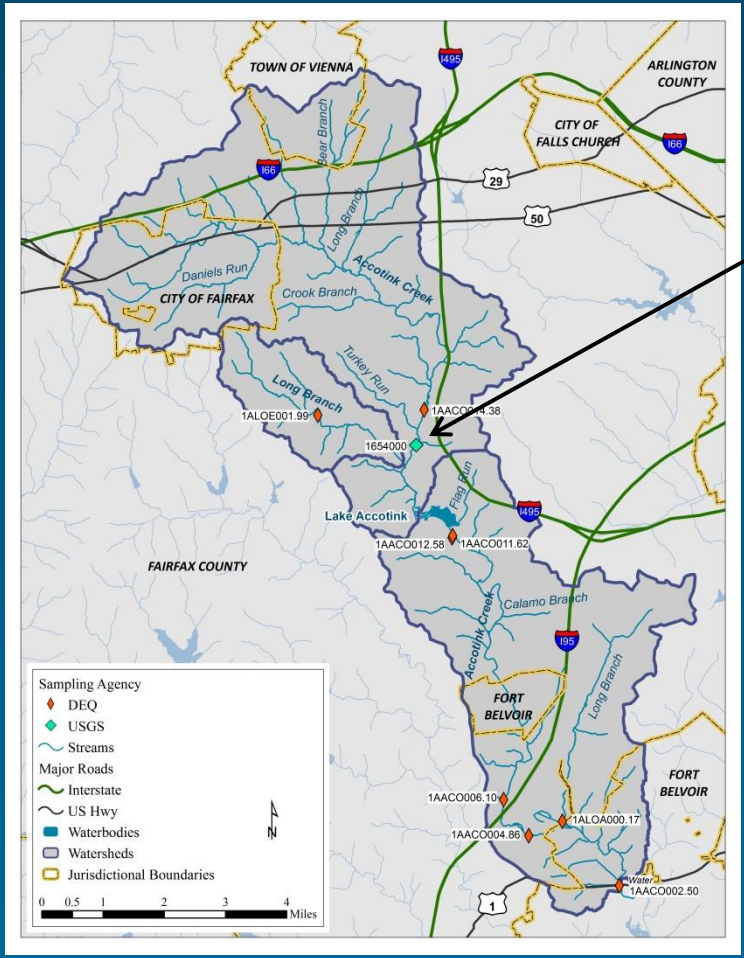


Temperature, DO, pH, Specific Conductance, Turbidity: 11/19/2011-01/13/2015

Temperature, DO, pH, Specific Conductance, Turbidity : 02/08/2013-present

Temperature, DO, pH, Specific Conductance: 08/03/2006-08/08/2006

Metals and Toxics Monitoring



USGS National Water Quality Assessment Program Site

DEQ Metals and Toxics Monitoring, 2000-2014

Medium	Metals	Toxics
Water Column	12 (dissolved)	4
Toxicity Tests		2
Sediment	3	2
Fish Tissue	11	7-16

Water Quality Standards and Benchmarks

Standard of Benchmark	Applicable Stressors
Water Quality Criteria to Protect Aquatic Life	Temperature, pH, Dissolved Oxygen, Chloride, Dissolved Metals, some Toxics
ProbMon Thresholds for Suboptimal Conditions	Total Nitrogen, Total Phosphorus, Habitat, Cumulative Effects of Dissolved Metals
NOAA Threshold Effects Concentrations (TECs), Probable Effects Concentrations (PECs)	Metals and Toxics in sediment
Tissue Values and Tissue Screening Values (Fish Consumption Use—protect human health)	Metals and Toxics in fish tissue

Non-Stressors

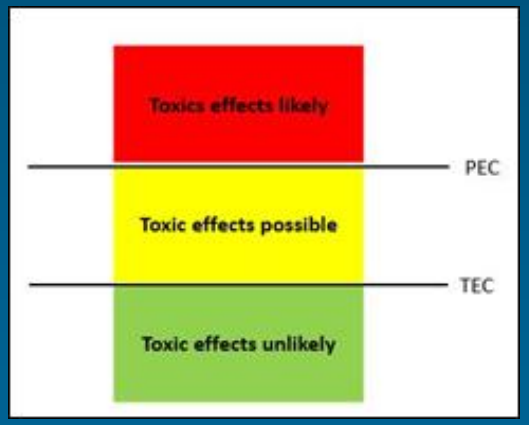
Constituent	Water Quality Standards Met?
Temperature	✓
pH	✓
Dissolved Oxygen	✓
Metals	✓

Possible Stressors

- Toxics
- Nutrients

Toxics

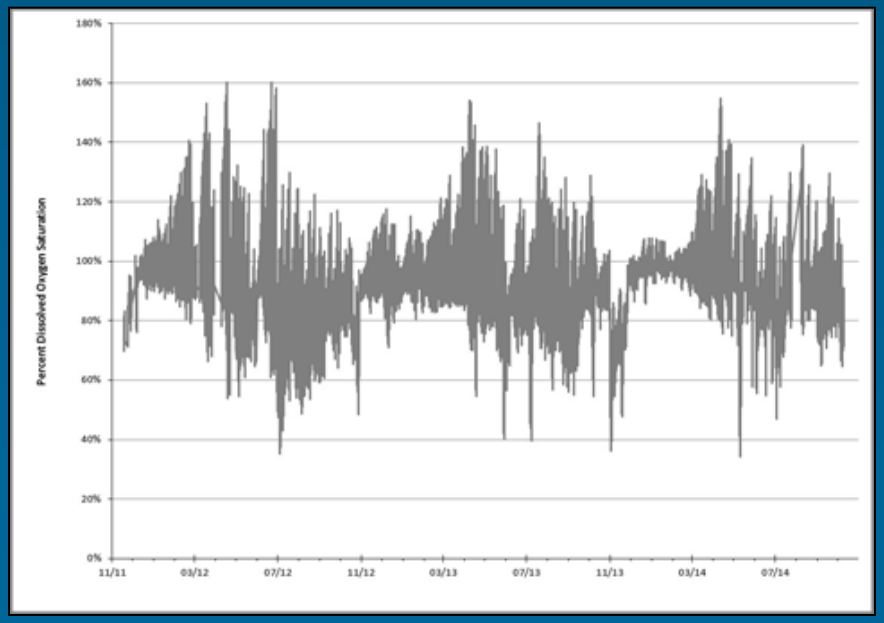
Medium	Key Observations
Toxicity Tests	• No evidence of toxics effects in two samples tested on water fleas • One of two samples tested on minnows had biologically significant effects
Water Column	No exceedences of Water Quality Standards
Sediment	Some PAHs and chlordane detected above TEC but below PEC
Fish Tissue	• Lower Accotink Creek not supporting Fish Consumption Use (human health criterion) because of PCBs • Some pesticides detected above Tissue Values in a few fish tissue samples



Nutrients

High TN and TP concentrations are observed, but are do not frequently occur.

Watershed	% Above TN Suboptimal Threshold	% Above TP Suboptimal Threshold
Upper Accotink	1%	13%
Lower Accotink	0%	8%
Long Branch	5%	19%

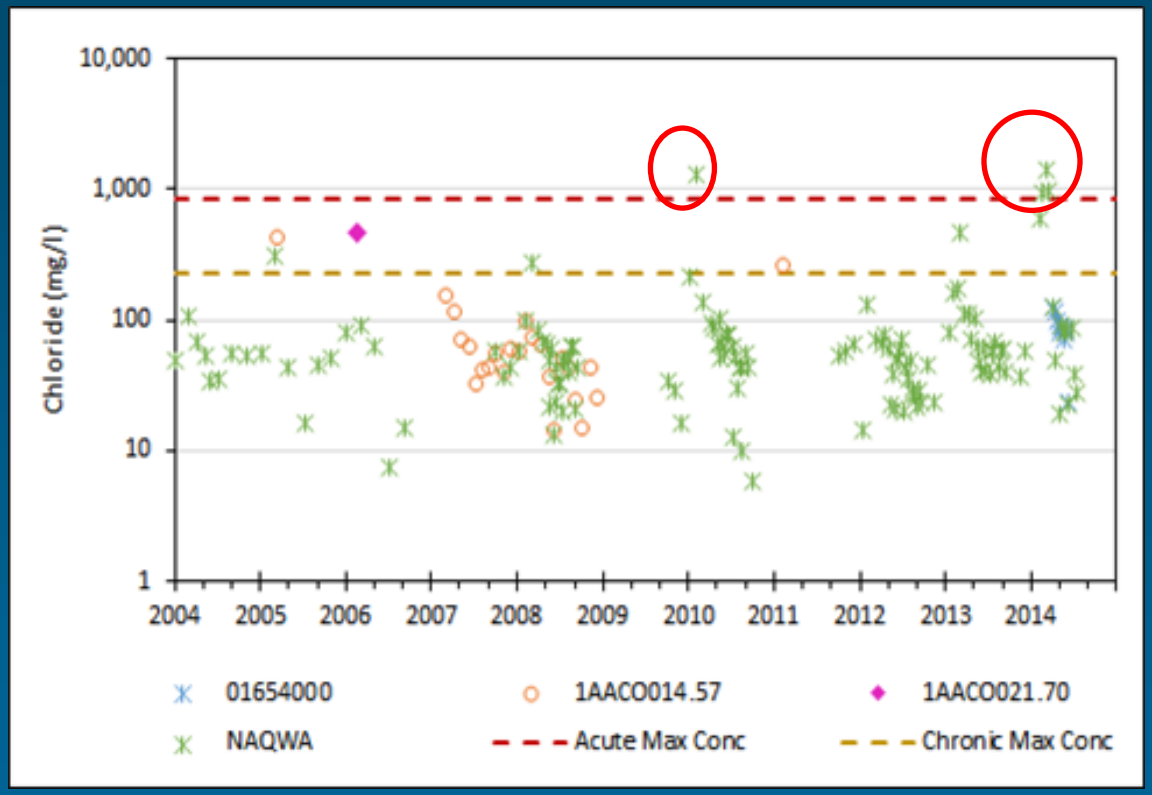


There are wide fluctuations in dissolved oxygen, possibly caused by excess algal growth, but water quality standards are still met.

Most Probable Stressors

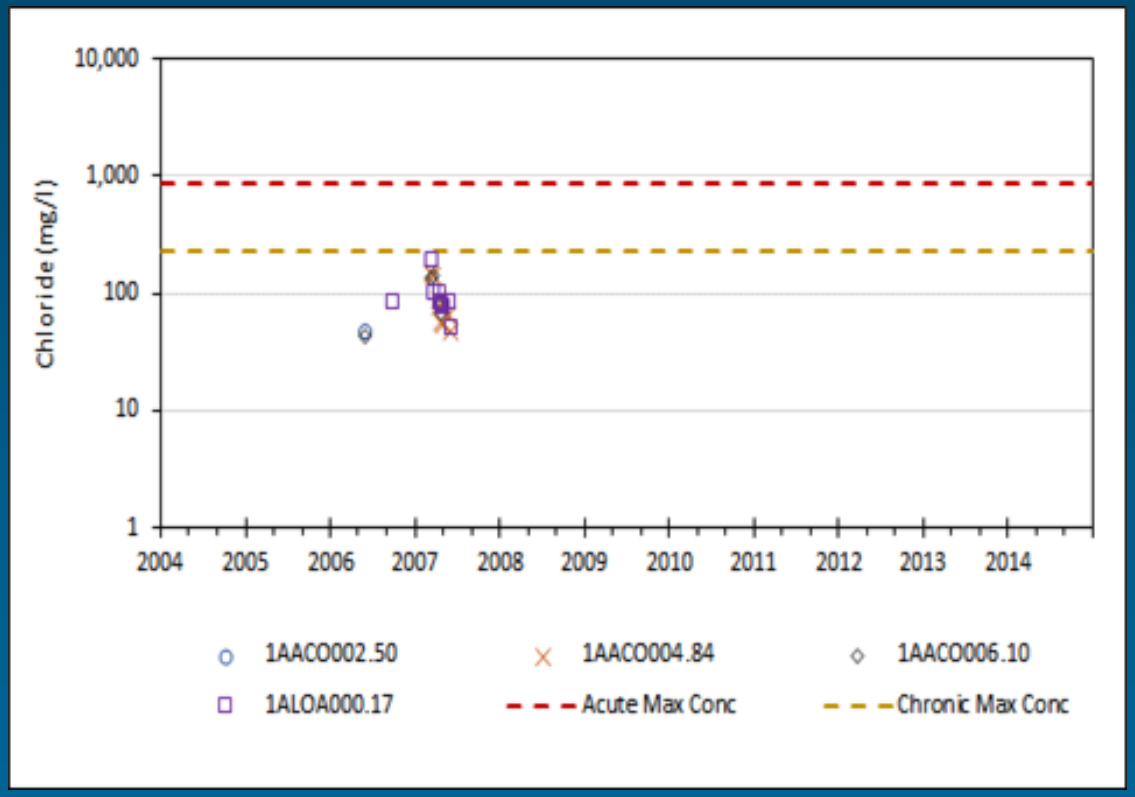
- Chlorides
- Habitat Modification
- Sediment
- Hydromodification

Observed Chloride Concentrations, Upper Accotink Creek



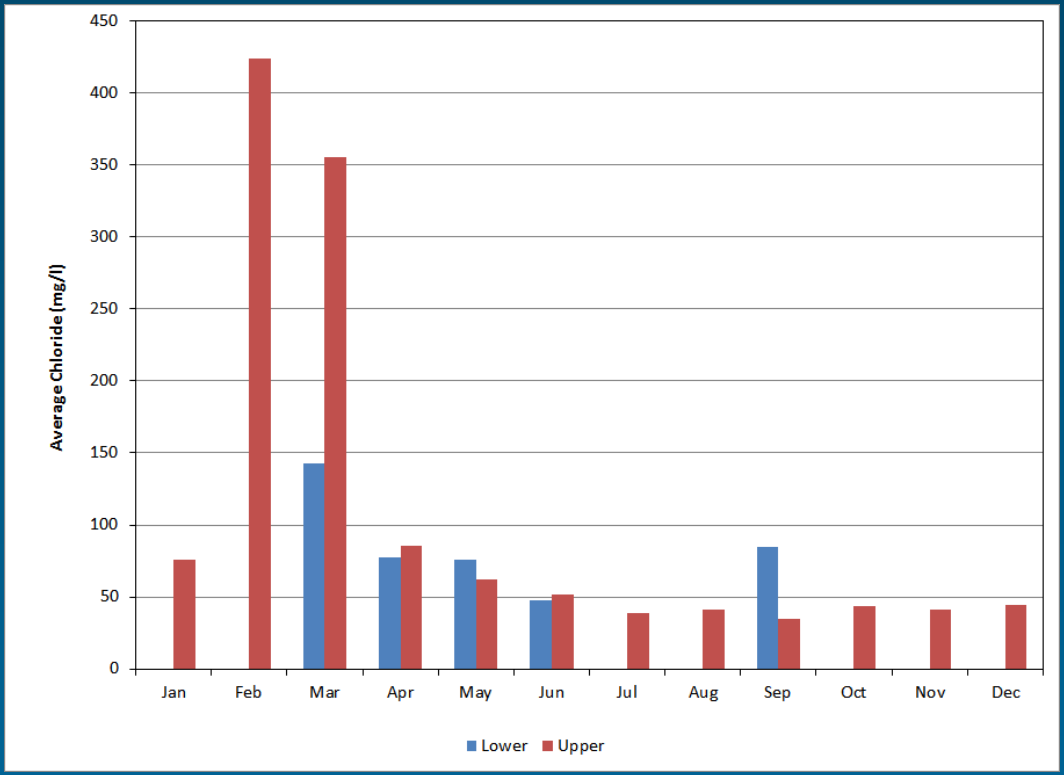
25 samples collected by DEQ and 146 samples collected by USGS, 2004-2014

Observed Chloride Concentrations, Lower Accotink Creek



23 samples collected by DEQ 2004-2014. (No samples collected by USGS.)

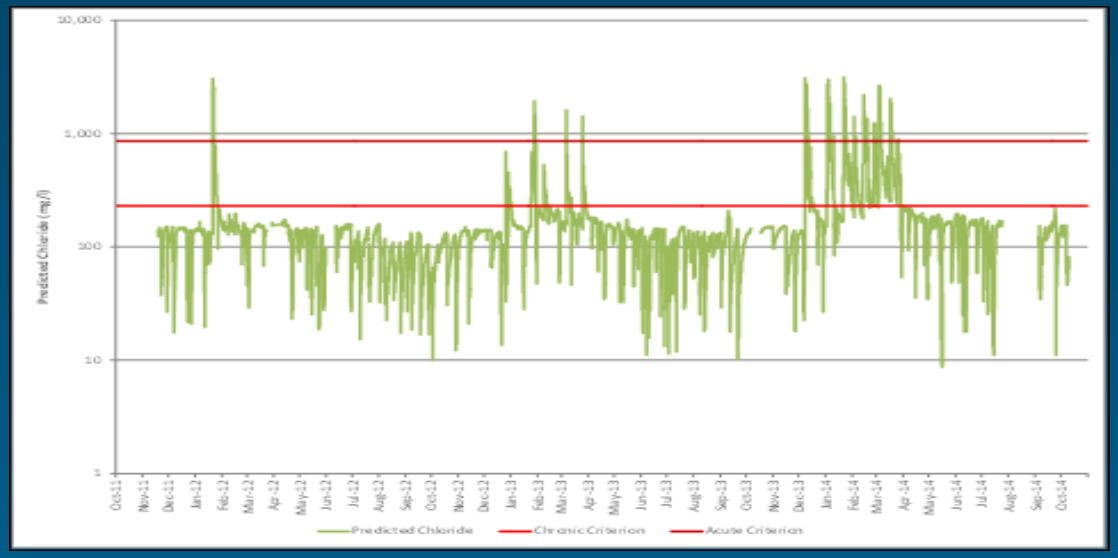
Seasonality of Chloride Concentrations



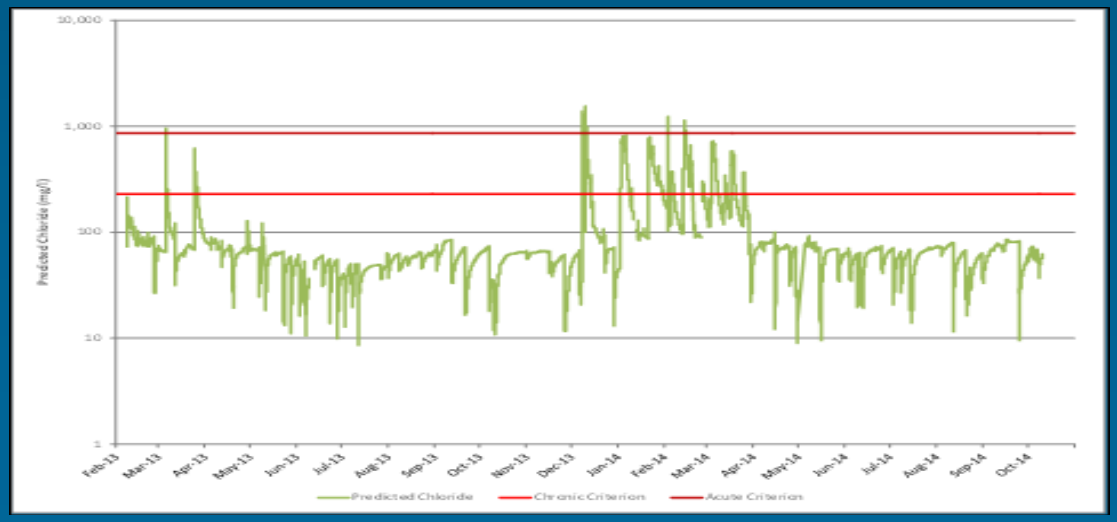
Estimated Chloride Concentrations

Chloride = 0.3 * Specific Conductance

Upper Accotink Creek:
32 days > acute criterion
12% exceedance of chronic criterion



Long Branch:
4 days > acute criterion
8% exceedance of chronic criterion



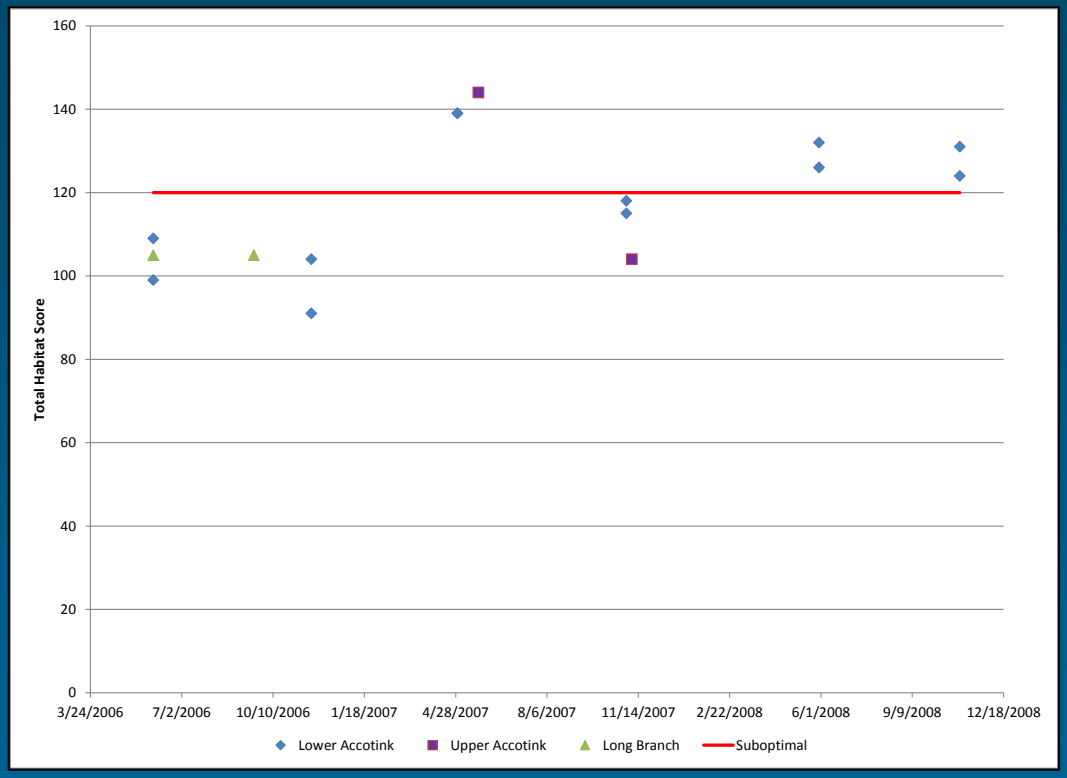
Lower Accotink Creek

- Don’t have winter continuous monitoring data for specific conductance, but
- Land use and percent impervious area in lower Accotink Creek similar to upper Accotink Creek
- Distribution of concentrations of Total Dissolved Solids (TDS) are similar, and TDS is correlated with chloride

DEQ Habitat Assessments
2006-2008

Poor Bank Stability*

Embeddedness*



*From Barbour *et al.*,
Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers

Fairfax County Stream Physical Assessment (SPA) Habitat Assessment

Rating	Percent Assessed
Very Poor	3.7%
Poor	30.5%
Fair	37.2%
Good	24.0%
Excellent	4.5%

Sediment: Impacts

Suspended Sediment

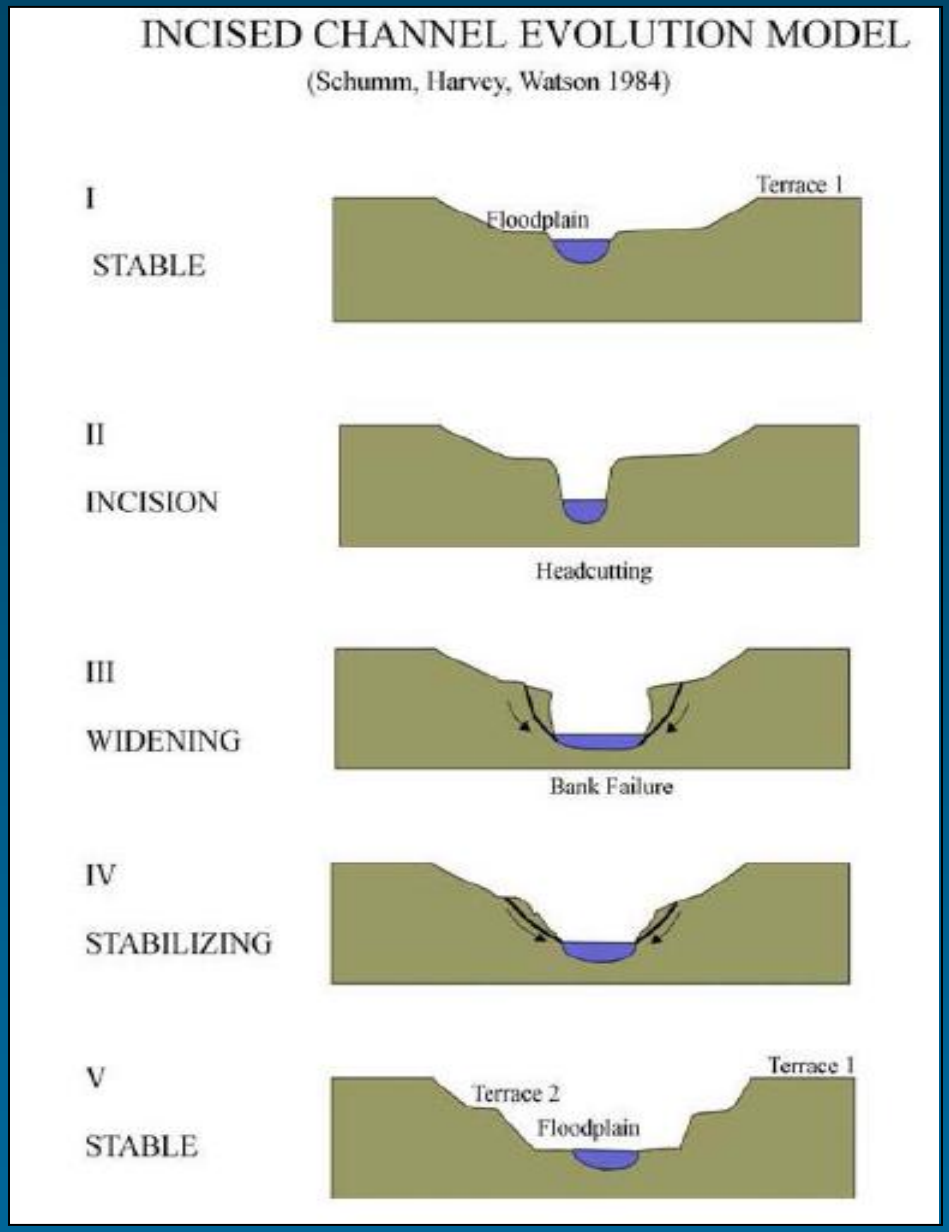
- Limits light for photosynthesis
- Reduce quality of food for filter feeders
- Reduced visibility for predators
- Increases drift and inhibits recolonization
- Damages stalks of plants, fish gills, and bodily parts of macroinvertebrates

Deposited Sediment

- Bury periphyton, macroinvertebrates, and fish eggs or larvae.
- Cover hard substrate favored by sensitive macroinvertebrates
- Fill in spaces between substrate used for refuge
- Reduce supply of gravel and clean substrate used for spawning by trout and other species

Fairfax County SPA Channel Evolution Model (CH2MHill, 2005)

90% of assessed reaches classified as Type III, actively widening channels



Hydromodification

Feature	Impacts
Increase in magnitude and frequency of flow during storm events	1. Increase in bank erosion 2. Increase in scour and dislodging of biota
Disconnection of streams from groundwater	1. Increase in temperature 2. Reduction in biological processing of nutrients
Channelization	Loss of habitat diversity
Replacement of small-order streams by storm sewer drainage system	1. Less biological processing of leaf litter 2. Loss of upstream colonists

Classification of Stressors

Category	Stressor	
Non-Stressors	Temperature	pH
	Dissolved Oxygen	Metals
Possible Stressors	Nutrients	Toxics
Most Probable Stressors	Chloride	Habitat Modification
	Sediment	Hydromodification

Stressor Analysis Conclusions

- Address the benthic impairments by developing TMDLs for pollutant stressors
  - Sediment
  - Chloride

- Non-pollutant stressors may be addressed through implementation practices
  - Hydromodification
  - Habitat Modification

Benthic TMDLs and Implementation

Stressor Analysis

- Data gathering and watershed information
- Identification of most probable stressors

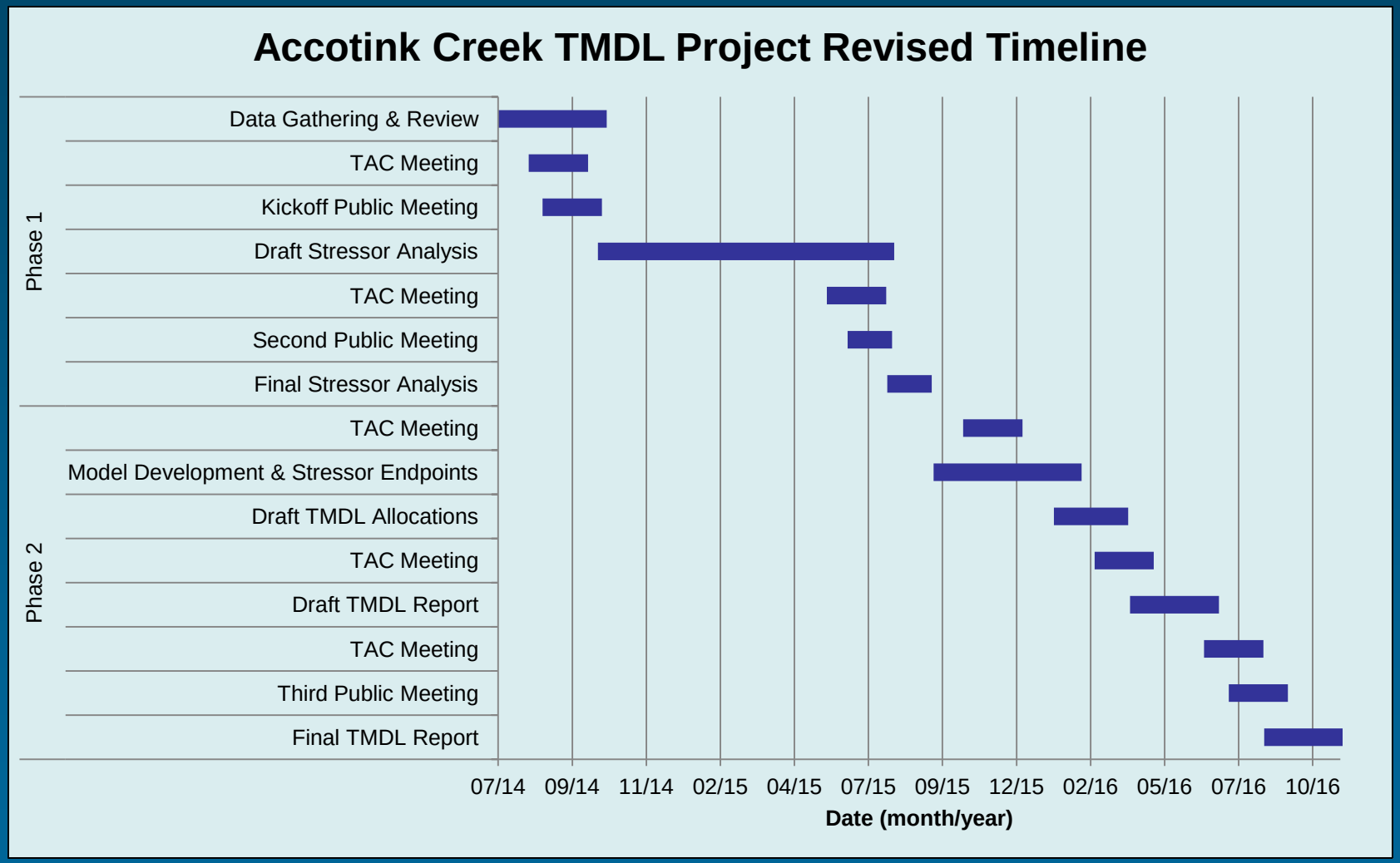
TMDL

- Modeling and establishment of endpoints for pollutant stressors
- Determination of loads and reductions

Implementation

- TMDL requirements implemented through permits for point source discharges
- Plans may be developed to address non-point sources and help coordinate efforts of regulated stormwater discharges
  - Collaborative process between stakeholders
  - Identification of best management practices and funding sources to address TMDL reductions

Proposed Project Timeline



Next Steps

- Draft Stressor Report:

  http://www.deq.virginia.gov/programs/water/waterqualityinformationtmdls/tmdl/tmdldevelopment/documentationforselecttmdls.aspx

- Comment period:

  July 6, 2015 to August 5, 2015

  Written comments can be submitted to:

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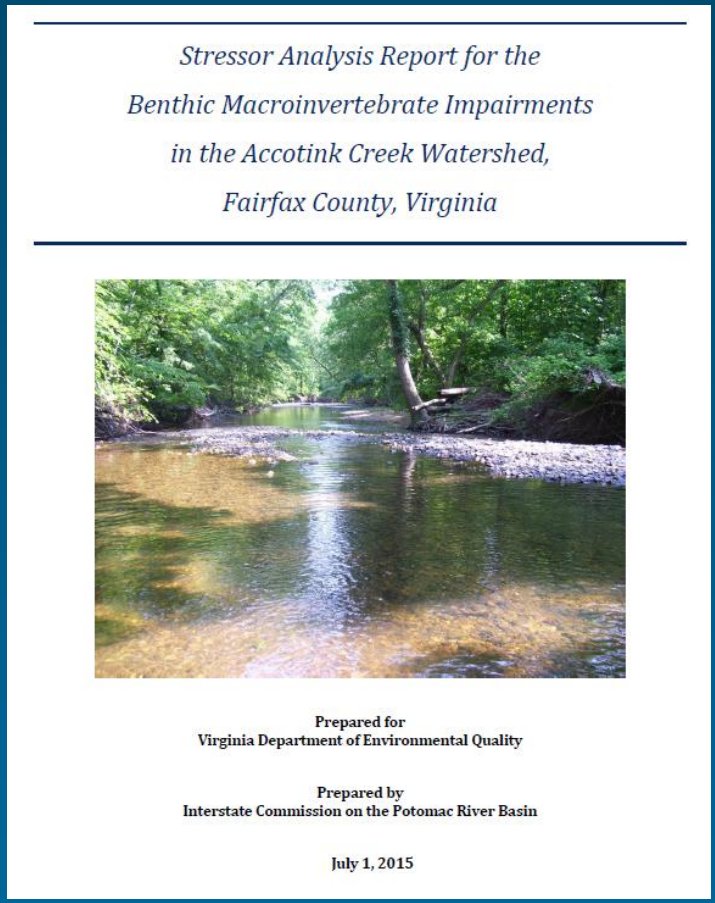
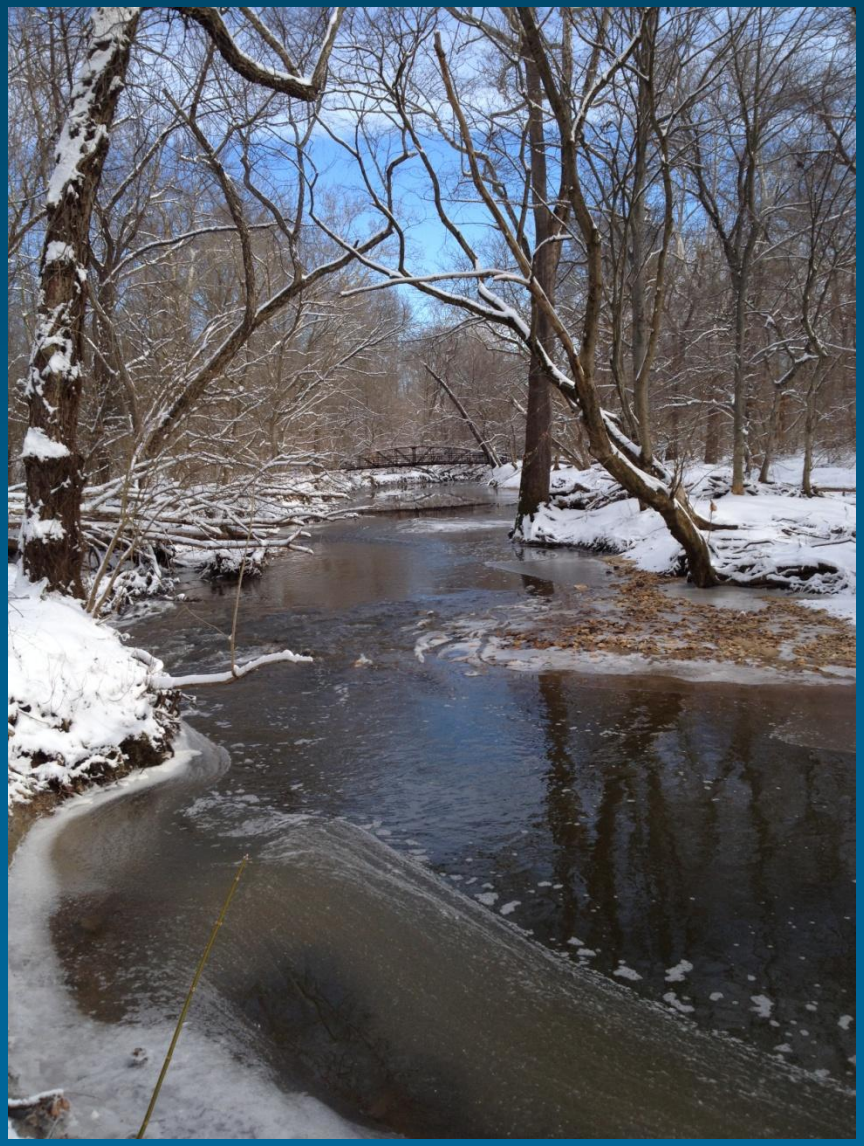
  13901 Crown Court
  Woodbridge, VA 22193



Questions? Comments?



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